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ABSTRACT

The Library of Congress hosted a 1-day conference, "Delivering Electronic Information in a Knowledge-Based Democracy" to explore the public policy framework essential to creating electronic information resources and making them broadly available. Participants from a variety of sectors contributed to wide-ranging discussions on issues related to building digital libraries, defining the roles of various players, and promoting the public interest and economic growth. Several members of Congress joined with Vice President Gore in acknowledging the importance of an advanced information infrastructure. The Librarian of Congress emphasized the need to sustain in the digital age the democratic equal access to information that libraries provided in the age of print. Libraries now confront the task of simultaneously maintaining existing paper-based collections, digitizing selected materials, and providing access to the rapidly growing volume of information originating in digital form. Collaboration between the public and private sectors is essential to promoting an advanced information infrastructure. Government can most effectively support the development of an advanced information infrastructure through a public policy agenda that includes: (1) updating the regulatory structure; (2) ensuring equitable access; (3) protecting intellectual property; (4) enhancing security and privacy; and (5) supporting the creation of digital libraries. An appendix lists the 46 conference participants. (SLD)

THE LIBRARY OF CONGRESS

DELIVERING ELECTRONIC INFORMATION *in a* KNOWLEDGE-BASED DEMOCRACY

Summary of Conference Proceedings
July 14, 1993

DELIVERING ELECTRONIC INFORMATION IN A KNOWLEDGE-BASED DEMOCRACY

SUMMARY OF PROCEEDINGS

FOREWORD

The construction of a National Information Infrastructure (NII) is a high priority for this country. As we stated in the Administration's *NII: Agenda for Action*, "Development of the NII can help unleash an information revolution that will change forever the way people live, work, and interact with each other." The conference on Delivering Electronic Information in a Knowledge-Based Society, held by the Library of Congress, is a valuable contribution to our efforts to establish sound public policies to promote an advanced NII.

The results of the Conference reflect our common goals for encouraging investment in the NII and ensuring that all Americans have access to these resources. Partnerships between the public and private sectors are essential to creating digital libraries and making them widely available on the information superhighways. I look forward to continuing to work closely with the Library of Congress and the many players represented at the conference in forging these partnerships and realizing the potential of the information age.

Al Gore
The Vice President

PREFACE

The idea for a conference on delivering electronic information originated in discussions I had with several members of the Library of Congress' James Madison Council. These private sector leaders agreed that the Library offers a unique forum for bringing together the many diverse interests concerned with the development of an advanced information infrastructure. Vice President Gore further encouraged our plans and generously offered to serve as Honorary Chair of the meeting.

The conference demonstrated that progress toward making digital information available to all Americans requires cooperation among those in Government, industry, academia, and the library community. The Library of Congress has a significant role to play in digitizing unique paper-based collections, organizing and preserving new knowledge created in digital form and maintaining effective policies to support intellectual property rights. Above all, the Library seeks to ensure that the public interest is well served during the transformation to the digital era. We intend to continue the important dialogue begun during this conference through future meetings and projects on key issues identified by the participants.

I thank the Library's Madison Council and Business Research Fund for their support of the conference. I also want to express my appreciation to the many Library of Congress staff and the Vice President's staff whose skills and dedication contributed to the success of the conference.

James H. Billington
The Librarian of Congress

EXECUTIVE SUMMARY

To achieve its promise, the National Information Infrastructure (NII) requires that a wide array of electronic information resources be easily accessed over the emerging digital highways. The Library of Congress hosted a one-day conference, "Delivering Electronic Information in a Knowledge-Based Democracy," to explore the public policy framework essential to creating these resources and making them broadly available. Participants from a variety of sectors contributed to wide-ranging discussions on issues related to building digital libraries, defining roles of various players, and promoting both the public interest and economic growth.

Several Members of Congress, representing different parties and regions, concurred with Vice President Gore that an advanced information infrastructure can empower citizens to participate more effectively in our representative democracy, dramatically improve educational opportunities, and create new jobs. Accomplishing this involves developing a consensus on the vision for the future, involving all elements of the public and private sectors, and transforming existing institutions. The Librarian of Congress emphasized the need to sustain in the digital age the democratic equal access to information that libraries provided in the age of print.

Access to networks and the creation of vast stores of online, digital, multimedia materials dramatically change the way libraries and librarians can operate. Libraries confront the task of simultaneously maintaining existing paper-based collections, digitizing selected materials, and providing access to the rapidly growing volume of information originating in digital form. Librarians will increasingly become managers, organizers, and creators of distributed sources of knowledge as compared to custodians of collections.

Collaboration between the public and private sectors is essential to promoting an advanced information infrastructure. Partnerships are needed for carrying out demonstration projects, developing standards, and improving access to networked information. Participants emphasized the importance of private sector investments in building digital highways and creating electronic products and services. Government's role should be to promote private sector investment and innovation, encourage open systems, ensure the public interest, and make Government information openly available.

Government can most effectively support the development of an advanced information infrastructure through policies that eliminate barriers to the application of new technologies and that promote the public good. Key topics for the public policy agenda include:

- Updating the regulatory structure
- Ensuring equitable access
- Protecting intellectual property
- Enhancing security and privacy
- Supporting the creation of digital libraries

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Summary of Proceedings

INTRODUCTION

On July 14, 1993, the Library of Congress convened 40 leaders from Government, the private sector, libraries, and the academic and user communities to explore issues related to electronic information delivery. Librarian of Congress James H. Billington chaired the day-long meeting and Vice President Al Gore served as honorary chair of the conference. The goal of the conference was to help shape the public policy framework for creating an advanced information infrastructure that both promotes the public interest and fosters economic growth.

Although much of the debate surrounding the development of a national information infrastructure (NII) has focused on the building of the digital highways for transmitting information, this conference focused its attention on the **content** to be transmitted. Specifically, the conference was organized around the three following themes that are vital to creating a robust and diverse array of electronic information resources:

- Building, locating, and preserving the electronic store of knowledge;
- Public and private sector roles; and
- Mechanisms for safeguarding intellectual property rights.

The morning sessions, led by Vice President Gore and Librarian of Congress Billington, shaped the major issues involved in the development of the NII. Several Members of Congress with strong interests in this issue area also participated in the morning session. The afternoon sessions focused on the three specific themes and discussed various models for accomplishing policy objectives.

The open discussion format permitted a wide-ranging debate on various aspects of building an advanced information infrastructure and resulted in a productive mingling of ideas among participants representing diverse perspectives. As stated by Dr. Billington, "We see this as a dynamic process where people present not only their own perspectives but have the chance to listen to others, to evolve thinking. We see it as a beginning of a continuing effort which we are happy to host here at the Library, to convene players in the electronic information age in order to forge new relationships, as well as move toward framing or suggesting some policies."

This summary will provide highlights of the day's proceedings. The first section presents the key elements of remarks by Vice President Gore, several Members of Congress who attended the conference, and Dr. Billington. The second section gives perspectives on the evolving roles of institutions in the new digital environment as reflected in comments of the participants. The third section offers a discussion of several key issues participants saw as critical to the public policy agenda.

PREPARED REMARKS

Vice President Gore

Reflecting the conference focus, Vice President Gore stated that digital libraries are as central to the creation of the national information infrastructure as is the development of information superhighways. He began the discussion by offering a vision of American society in the 21st Century and issuing a challenge to the conference participants. The Vice President sketched an image of a young child at home accessing, in exciting, captivating, and energizing forms, an entire universe of knowledge. This universe would be available in ways that corresponded with that child's natural curiosity, responding instantaneously to questions as they occurred to the child. The challenge, then, involved establishing a consensus on the steps needed to configure data and deliver it to the child through appropriate networks.

The Vice President observed that an advanced information infrastructure will solidify the standing of America's information marketplace as the most robust and competitive in the world. The private sector will create an entirely new generation of information services, just as unimaginable as electronic mail was before the existence of Internet. To tap this enormous potential, however, the United States must make the necessary investments to build the national information superhighway.

Construction of this information superhighway, the Vice President stressed, required the collaboration of the public and private sectors. He likened the effort to the construction of the interstate highway system in the 1950s and 1960s. The interstate system spawned the creation by states of a vast number of four-lane, limited access, high-quality highways. This construction frenzy occurred only after the vision of an interstate system became ubiquitous, the standards were set, and the location of the backbone interstate highway became known. In today's setting, the private sector will build the information superhighway. There will be, however, an appropriate role for the Government in supporting the advanced backbone network, setting the standards, ensuring interoperability, guaranteeing benefits to the public, and developing the vision of future generations of information products and services. In addition, Government and the private sector need to work together to extend the national information infrastructure to schools and libraries.

Vice President Gore noted that the Administration has initiated several efforts as part of a new Government-wide policy for supporting the national information infrastructure. These included forging consistent and coherent telecommunications and information policies by bringing together key agencies under the aegis of the White House Information Infrastructure Task Force; enhancing public access to Government information by establishing clear dissemination guidelines through revisions to Office of Management and Budget Circular A-130; and supporting networking efforts by schools and libraries through demonstration projects of the National Telecommunications and Information Administration of the Department of Commerce. The Vice President concluded by observing the critical linkage between information and representative democracy. The printing press first gave Americans the civic knowledge needed to choose their political leaders. What, then, will become possible if citizens are empowered with the array of knowledge someday available through the national information infrastructure?

Members of Congress

Three members of Congress—Sen. Robert Kerrey (D-NE), Rep. Newt Gingrich (R-GA), and Rep. Edward J. Markey (D-MA)—also offered their thoughts on creating an advanced information infrastructure. Although representing different political and regional interests, each observed that the emerging information technologies allowed us to empower citizens to make decisions about their lives and to rethink prevailing regulations and bureaucracies. All also noted the need to establish partnerships to make this future a reality.

Senator Kerrey offered his vision of a digital library that would link the technology in the home to the curricula of the classrooms. From their homes, students would access the library's multimedia collections to enhance their learning in school. Senator Kerrey suggested that we take advantage of this and other information technology tools to revisit the public education systems established throughout America at the beginning of the 20th century. Noting that school boards devote the bulk of their efforts in arranging for children to come to school, he proposed a new approach centered around the knowledge students will need during the course of their lives. Implementing this proposal will require bringing together parents, teachers, information specialists, policymakers, and the business community as well as changing regulatory structures. The successful accomplishment of these goals would result additionally in the creation of new jobs and wealth.

Representative Gingrich also proposed a vision of the future, one in which the intersection of the electronic and computer revolutions would reshape citizens' relationships with their Government. He saw the creation of this new vision to be the key challenge facing policymakers. The information revolution provides an opportunity to transform current structures fundamentally and to challenge existing bureaucratic structures. By 2010, Representative Gingrich forecast, we may have in place a home-based capacity for reeducation, job search, health maintenance, and other resources. He urged a debate over the potential power each citizen could have under such a system; how to maximize the opportunity to get this power; and what the Government should do to ensure that this occurs. He also challenged participants to describe these future opportunities in language understandable by the average American so that they can get "hooked on the dream." Representative Gingrich proposed information empowerment zone demonstration projects to test how to deliver information to meet the needs of the poorest Americans.

Representative Markey concurred with his colleagues in noting the tremendous societal possibilities offered by the emerging information infrastructure. In a future America, a child may be able to plug into digital libraries as easily as into video games. To make this vision a reality and to meet new challenges of rapid technological change and massive global competition, Representative Markey called for updating current telecommunications rules and regulations. In addition, he advocated a diversity of competing providers of information services to the home and a redefinition of universal service in the digital era. Finally, he urged steps to protect privacy and to ensure that all Americans, regardless of income or race, have full access to the benefits of the information highway.

The Librarian of Congress

Dr. Billington then presented his thoughts on the role of the Library of Congress and other major research libraries in a digital world. Dr. Billington noted that the Library of

Congress—the world's largest and most varied repository of information—served as a natural setting to discuss the policy framework for an advanced information infrastructure. He concurred with the vision of the future in which the innovation of the private entrepreneur and the dedication of our democratic Government to citizen access to information combine to serve learning, creativity, and productivity even more than it has in the past. The Library of Congress is a largely untapped asset for the information age that should be used to benefit the entire country.

The Library of Congress, like most libraries, Dr. Billington observed, must move into an electronic environment to meet their core missions to gather, organize, catalogue, preserve, and make widely available their collections. The challenge will be to use new digital technologies efficiently and establish cooperative efforts to improve access to vast collections. The Librarian of Congress noted that certain forms of information, such as census statistics, technical journal articles, Government reports, and economic data, already existed in digital format, and that other types of information, such as complex maps, might soon be available *only* in a digitized version. Libraries will need to provide access to this increasing volume of new digital materials, as well as to digitize unique, and decaying, 19th and 20th century paper documents.

Dr. Billington noted numerous Library of Congress projects underway that contribute to an advanced information infrastructure. These included testing, in conjunction with the Advanced Research Projects Agency and five academic libraries, an electronic copyright management system to automate registration, receive digitized deposits, and facilitate licensing and dissemination of materials; digitizing, through the American Memory project, basic American history collections and providing access to schools and libraries throughout the country; and placing library exhibits on-line on both the Internet and commercial systems. He noted the importance of establishing an efficient system under which the rights of authors and copyright owners are fully recognized, arrangements for clearances, permissions, and licenses are worked out, and payments are made.

Yet, Dr. Billington also observed, the Library of Congress and other major libraries faced increasing budgetary pressures that could erode their ability even to maintain basic collections, much less expand services. The Nation needed, the Librarian warned, not only a digital highway but the intellectual cargo to traverse that system. With these concerns in mind, Dr. Billington asked the conference participants to consider three questions:

- How will our society fund the digitization of non-commercial, non-entertainment materials?

- What is the proper division of public/private labor in creating, storing, organizing, marketing, and distributing information?

- How can we avoid creating a society of information haves and information have-nots?

Dr. Billington also noted that the Library of Congress has a special obligation to help define, as well as serve, the general public interest. In this respect, policymakers must determine how to sustain, in the electronic age, the democratic equal access to information that free public libraries have provided in the age of print.

EVOLVING ROLES IN A DIGITAL ENVIRONMENT

We are in the midst of an information revolution that is significantly changing the way institutions operate and the roles they play in our society. These fundamental changes are occurring at such a rapid pace that they challenge leaders in Government and the private sector to develop effective new policies and practices that will facilitate achieving the promise of the information age. This transformation is driving consideration of new approaches to the way information is delivered to the public, a reevaluation of traditional institutional roles, and establishment of new types of relationships among different players. Throughout the conference, participants provided their perspectives on how the emergence of a digital environment created changing opportunities for libraries, Government, and the private sector. They also offered insights into new roles for the public in participating in a networked society. Finally, many participants commented on the new opportunities for collaboration that now exist to promote the creation and delivery of electronic information for both commercial benefit and the public good.

Libraries

Libraries acquire, catalogue, make available, and preserve collections of various kinds. In a traditional context, collections often consist of books and other published materials which are stored in a central facility. Thus, access is limited to those who can travel to the respective library or await an item's arrival through interlibrary loan. Once an item has been lent to one reader, it becomes temporarily unavailable to all others.

Participants observed that an advanced information infrastructure dramatically changes many of these historical operations and relationships. Increasingly new forms of unpublished (and therefore unauthenticated) digitized materials are emerging as millions of users are linked by computer networks worldwide. As one participant noted, "there is a massive parallel creation of digital multimedia library materials that, by and large, is taking place outside of the library sector." The volume of this new digital material, if it were on paper, dwarfs the existing library buildings and their holdings. The situation is additionally complex because digitized information can be updated continuously, manipulated and combined with other materials, and viewed in multiple ways. Digital data thus creates enormous new amounts of dynamic knowledge that may exist only at the moment and never be stored anywhere permanently. Institutions, including libraries, may provide access to and global distribution of these materials without physically controlling them. Multiple readers can access the same material at anytime and from anywhere.

What roles should libraries and librarians perform in this new environment of exponential growth of digital information? To what degree will the library community make access to digital materials a priority compared to other core services, such as storage, cataloging arrearages, and preservation? To what extent does digitization offer potential solutions to these problems? What kind of standards need to be developed to collect, provide access to, and authenticate digital data? Participants noted that libraries are heterogeneous entities that offer a wide array of services. They also saw distributed libraries providing a variety of evolving services since, as the network of digital materials grows, redundancy of holdings is no longer necessary. Some participants questioned whether libraries still had a unique role given broader access to digital information, whereas others maintained that libraries needed to ensure a sense of community and provide publicly subsidized access to information in all formats. In addition, many roles will be shared with other agencies or organizations.

Consensus emerged that the role of librarians may change significantly as they become increasingly viewed as managers of knowledge. These knowledge management skills may take many forms and can be expected to involve librarians in all facets of the information chain. Librarians will be present at the information generation process, perhaps advising authors on outlets for these new creative works. Librarians will also help place digital materials under some form of control, thus assisting people to deal with the morass of information. There will be a growing need to organize digital information on the networks from the standpoint of the users. New approaches, such as "mapping" data through a form of geographic organizational system, offer interesting possibilities for indexing not only what content exists, but where it exists. Librarians will increasingly function as facilitators, enablers, and teachers to potential users of computer networks. They will instruct people in using networks, creating intellectual content, manipulating data in new ways, and fashioning visualizations of abstract content. Librarians may manage both certain types of networks and skilled volunteers responsible for organizing information in an intelligible fashion. These efforts will better enable users to find materials on their own. Finally, librarians will negotiate network access rights on behalf of some public users.

An advanced information infrastructure creates new vistas for librarians in support of their constituents. For example, librarians can more readily access materials from other countries to better serve a multicultural America. Yet participants cautioned against assuming that all, or even most, library collections will be digitized. Materials will appear in print, on microfiche, on CD-ROMs, and through a whole host of other formats. The daunting task confronting libraries, one participant observed, will be to deal with simultaneous technologies and attempt to integrate them into a seamless network or system. The challenge will further involve handling materials originating in digital form, converting critical collections to digital formats, and maintaining access to other items which may never be digitized. In this new "neographic institution", librarians will need to rely on the best of the traditional and current worlds and move to the future.

Public and Private Sectors

The creation of an advanced information infrastructure will require the investment of billions of dollars over the next decade. The private sector has already marshalled substantial resources towards this enterprise and is expected to intensify its activities. Representatives from the private sector stated that the building of the actual digital highway is well underway and does not require public funds for its construction. Given the massive and continuing Federal budget deficit, conflicting funding demands, and the efforts of the commercial sector, the Government's role should be focused on other aspects of the information infrastructure. General agreement also emerged, as one conference participant noted, that this venture is too complex, distributed, and pervasive to be handled strictly as a Government initiative. Indeed, several participants noted that the concept of public and private sectors needed to be redefined to encompass the full range of key players in the building of an advanced information infrastructure. These include the vast volunteer force that contributes to the Internet and local communities that can add to and benefit from the wealth of information resources that are becoming available digitally.

Participants envisioned a close partnership of the public and private sectors and advocated a number of specific roles for Government and private industry. In addition to the importance of private investment in building the digital highway, participants recognized the

vital role the private sector is already playing in providing valuable information products and services. The private sector has strong incentives to help eliminate barriers of access to electronic information resources and continues to make sizable investments to accomplish this goal. The participants also overwhelmingly agreed upon the need for a strong Government presence in the evolution of the information infrastructure. As one participant stated, there needs to be a "collaborative role" for Government so that it can enable things to happen, advance cutting edge technology, and speak on behalf of the people of the country. To accomplish this, Government needs to support the following areas:

Promoting Innovation

The Government can play an important role in promoting private sector investment and innovation. This role might require the Government to convene key players, resolve divisive issues, and make things happen. This might also take the form of funding critical demonstration projects in technology and research. For example, several participants observed that a relatively modest public investment in the Internet had leveraged enormous private sector and research community activities. At the same time, the private sector understands well what consumers want and has created significant pieces of the infrastructure based upon consumer spending. Future innovations may be in part dependent on the transition to new regulatory structures not bound by outmoded technological distinctions and policies that promote capital investment. Government also has a role to play in preserving intellectual property rights of information creators and distributors in the digital era.

Encouraging Open Systems

An efficient and effective information infrastructure requires open, accessible, and interoperable architecture for all systems. The Government has a significant responsibility in encouraging standards and regulations that promote openness, while not imposing requirements that would limit the flexibility of the private sector. The endorsement of open systems will permit greater opportunities for a wide range of applications and services to be developed. To support this, the evolving regulatory framework needs to encompass a long-term view that supports interconnection of different components of the information infrastructure. Openness also involves developing systems that are usable to the average citizen. There is much to be done by all players to improve ease of access to digital information and facilitate broad-based use of networked information.

Ensuring the Public Interest

The Government has an obligation to ensure that all Americans derive the benefits of the information highway. To accomplish this involves performing an oversight role to encourage a balance between commercial interests and the public good. Related to this is the need to promote educational and cultural resources as essential cargo on this highway. Public service applications that have less commercial viability are candidates for Government support. This category also would include many traditional library functions, such as preserving knowledge and providing access to information for those who cannot afford other sources. The Government may also provide incentives for the private sector to fund projects that advance the public interest. As stated by one participant, there is a major opportunity for the digital

highway to be a catalyst of change to overcome the tremendously growing disparity among groups in this country. To capitalize on this opportunity will require that adequate "ramps" to the highway are built to all communities, including the inner cities and rural areas. This includes providing equal access to technology and information in schools and supporting relevant education and training.

Creating Databases of Government Information

Federal, State, and local agencies collect and process enormous amounts of information in the course of meeting their specific missions. Increasing amounts are already digitized. The Government can significantly enhance both national educational and research goals and America's competitiveness in the global marketplace, several participants noted, by making this wealth of information available electronically. They urged a collaborative effort under which Government creates the wholesale data base and the private sector develops retail information products for public consumption. The availability of Government information in digital form provides enormous opportunities for the private sector to create a multiplicity of value-added materials and services. The private sector also is critical for developing more "user-friendly" tools to enhance access to Government information. At the same time, participants believed that the Government needed to maintain its archival and preservation functions, develop locators to the growing store of Government data, and guarantee public access to Government information.

Opportunities for Collaboration

Participants frequently mentioned collaboration and partnerships in describing the opportunities presented by the advanced information infrastructure. Discussion focused on promoting new forms of collaboration between public and private bodies in the higher national interest. Speakers identified specific challenges, such as making it easier for people to access networked information or developing standards. One participant suggested collaboration between the library sector and the volunteer force on the Internet so that the volumes of information could begin to be organized before it "collapses under its own weight."

Participants advocated better dialogue among the Government, private sector, academia, and other communities involved in information generation and distribution. This dialogue is critical to developing a higher level of trust and partnership between the private and public sectors to serve the long term public interest. Working collaboratively, many stated, offered the only way to continue the advancement that has been achieved in building the Internet — the vehicle for a wide range of partnerships among traditional competitors and the basis for forging new partnerships globally.

Participants offered a number of existing models of effective collaboration. Many of these involved improving educational opportunities and access to library materials and Government information. There is a need to better disseminate information about these efforts so that others can learn from them. It is also important to evaluate how scalable individual projects may be for broader national programs.

PUBLIC POLICY AGENDA

The continued development of a national information infrastructure requires the support of Government through effective public policies that clearly define the Federal role and

promote private investment. These policies need to focus on eliminating barriers to the growth of networked information, ensuring widespread access to digital information resources, and advancing innovation. Participants identified several priority areas for attention on the public policy agenda. They included updating existing regulatory structures; protecting intellectual property rights; ensuring equitable access to public sources of electronic information; enhancing integrity, security, and privacy of digital information; and creating digital resources for research and education.

Updating the Regulatory Structure

The information revolution involves the convergence of a variety of technologies in the creation of new products and services. Some of these technologies have emerged in essentially unregulated environments, while others have been heavily regulated. In addition, industry lines no longer adhere to clearly defined technology spheres as technological advances have blurred distinctions between them. Because regulation occurs at both the State and Federal levels, revamping regulations is especially challenging.

Participants indicated that current regulations prohibit or make uneconomical a variety of private sector facilities construction and services activities. According to one participant, the labyrinth of regulation is withholding the deployment of very high performance, full service networks and there is a need to break the regulatory gridlock to facilitate the national deployment of broadband services. Another participant noted that existing depreciation policies fail to account adequately for the rapid rate of technological development and the high cost of research and therefore limit investment in infrastructure. The increasing number of experiments that bring together players from different industries will help to move regulations forward to reflect the new technical and market realities. Several speakers cautioned against Government-mandated changes that limit flexibility for information service providers.

Congressman Markey stated that while the regulations that were established in the 1930s to promote universal service, localism, and diversity served the country well, they now need to be updated to meet new challenges of rapid technological change and global competition. By promoting competition among several providers, the creation of single industries or companies that dominate the control of content can be avoided. The need to redefine universal service in the digital era is another key component of modernizing existing regulations.

Ensuring Equitable Access

The need to ensure equitable access to digital information resources is a major public policy concern. The Government historically has provided information "safety nets" through such mechanisms as funding for libraries, requirements for universal telephone service and community programming on cable systems, and subsidizing the mail for delivery of books to schools and libraries. One participant cautioned that, as we move into the new era of technology, we risk leaving a large segment of our population behind

Several speakers emphasized the potential for empowering disadvantaged individuals by equalizing access to networked information resources. The Government has a responsibility to make sure that all Americans, regardless of income or ethnic background, are able to access the digital information highways. The last mile of wiring must reach all homes and all schools, particularly in communities of need, rather than solely profitable markets. A combination of Government and private sector demonstration projects is needed to achieve this goal.

Access to digital information requires not only that the material reaches schools, libraries, and communities, but that it can be effectively used. Participants highlighted the need for training, improved ease of access, and teacher development to remove the barriers to using new technologies. It is essential to integrate the educational component in the building of the information infrastructure and to retrain people to operate effectively in a networked environment.

Libraries traditionally have provided publicly subsidized access to information and knowledge. They often serve citizens unable to afford other avenues for obtaining information. Several speakers advocated some sort of pricing adjustments or Government support to enable libraries to provide new electronic tools for maintaining their mission in the digital age. One participant suggested that libraries offer free access to networked data in its basic form, while customized information services to the home would be fee-based. Another suggested that libraries need to continue their role as a financial buffer by paying for commercial information and then making it available for free to the public. This both compensates the owners of information resources and provides access to those who are not able to afford it. In an era where public funding for libraries has decreased dramatically, new approaches to supporting the role of libraries may need to be explored.

Protecting Intellectual Property

The protection of intellectual property through copyright is an essential component of a knowledge-based democracy. The Founding Fathers recognized that the political and economic vitality of the new American Nation depended on the creation and dissemination of knowledge, described in the Constitution as "the Progress of Science and useful Arts." As an inducement to promote such progress, the Founding Fathers authorized Congress to grant authors exclusive rights to their writings for limited times. Over the past 200 years, the copyright system has served the Nation well by spurring all forms of new intellectual endeavor.

An advanced information infrastructure presents three significant and qualitatively new challenges to protecting intellectual property. First, digitization offers an unprecedented easy and inexpensive method to produce an indefinite number of perfect copies. Second, information in disparate media can be converted into a single digital stream and can be easily manipulated to create a variety of new works. Third, digitized information can be instantaneously distributed to and downloaded by thousands of users across a global network system. One participant reflected the concerns of many information creators and distributors of content that their investments will be lost if a single copy could be transmitted across national and international networks without any controls or compensation.

Conference participants recognized these challenges and proposed several courses of action for policymakers to consider. One recommended a campaign to educate the public about the role of copyright in sustaining the creative process and its contribution to society. This might lead to greater adherence to copyright laws. Another speaker urged Government action to ensure that the technical architecture of the digital highway protected the rights of copyright owners. Still others stressed the need for a management system encompassing copyright registration, information authentication, and a clearinghouse for users seeking access rights to digital materials.

Participants also debated but did not achieve consensus regarding models for remunerating the creators of digital information. Advocates of a collective administration system argued that it offered an efficient compensation method and avoided the substantial costs required by

a transactional model. The collective approach has the advantage of not requiring a direct link between copyright owner and user. Those favoring a transactional model claimed that contemporary technology allowed multiple transactions to be handled cheaply and efficiently. Indeed, technology may now provide a rationale for revisiting previous collective arrangements, which required Government involvement and regulation. Several participants strongly suggested that a mixed approach, including both collective administration and individual transactions to compensate owners, would be more likely than any single approach. The precise method selected would depend on the industry, the type of material, the available technologies, and the nature of the customer base.

Finally, some participants emphasized that a comprehensive copyright policy must address not only intellectual property and remuneration concerns but also the research community's continual and legitimate information needs. Access to digital information was essential, they observed, to ensure the vitality of the research enterprise. From this perspective, then, policymakers must guarantee continued fair-use exceptions to copyright for researchers, educators, and the general public.

Enhancing Security and Privacy

An advanced information infrastructure offers exciting opportunities for improving educational quality, streamlining Government operations, and strengthening economic competitiveness. Security and privacy must be integral parts of the overall effort to create such opportunities. It is counterproductive to create digital instructional materials, for example, if we cannot ensure the integrity of the information. Likewise, the economy will be harmed if software manufacturers lose control of their products after placing them in the information pipeline. In a third context, a digital library that cannot protect its circulation records becomes a threat to civil liberties.

Securing digital information must include adherence to several minimum principles. First, as noted throughout the conference, disseminators of data must take appropriate steps to guarantee the integrity of that data. In a traditional environment, one speaker observed, publishers and information providers served a quality control function in distilling information from data and then disseminating such information. In a digital environment, users must be assured of comparable quality control. One speaker suggested that there will be new approaches to peer review that are based upon input from colleagues on the network, rather than relying upon a few experts. Second, controls must be instituted to authenticate and authorize potential users of digital databases. Third, measures are required to prevent unauthorized data manipulation or modification. Finally, another speaker noted, we must recognize that the national information infrastructure is already being connected into the global infrastructure. Governments and research communities worldwide must coordinate security to ensure that international transactions can be validated, privacy is protected, and contingency plans exist to handle a potential global information disaster.

Action also must be taken to prevent unauthorized dissemination of personally identifiable digital information. Participants commented on the need to revise existing privacy laws to reflect the impact of broad access to personally identifiable information over networks and to establish new principles for privacy in cyberspace. Technology and effective systems management must be emphasized to prevent unauthorized disclosure of personal communications and information. Resolution of encryption policies is needed that will support both privacy and security objectives.

Creating Digital Libraries

Researchers and educators require access to a wide range of information resources. These resources may consist of materials generated and largely used by the research community itself as well as information produced and/or consumed by other public and private organizations but nonetheless essential to scholarship and teaching. As we move increasingly to a digital world, we need to ensure that a wide range of information remains accessible for research and instructional purposes. Addressing this broad policy goal raises numerous questions for consideration. First, what is the best strategy to build this corpus of digital information? Second, who will organize this information so that researchers can locate and use it? Third, who will preserve these materials for future research? Fourth, what standards need to be established? Finally, how will this entire effort be funded?

Building Digital Resources

The electronic resource base of the future will consist both of information originating in digital form and material converted to digital form from other media. Several participants noted distinctions between converting older materials and capturing new material in electronic form. Each presents particular challenges and may necessitate different strategies or incentives to produce them. An effective resource-building strategy must include identifying the huge volume of materials, such as pre-publication manuscripts, scientific data, and materials created on the Internet that either begin life digitally or exist solely in that form. One participant proposed mandatory copyright deposits in digital form as the way to acquire the digital version of printed materials. Such deposits could significantly reduce the costs associated with future conversion efforts.

Participants also proposed criteria for determining conversion of non-digital materials. One criterion concerns the use of such materials. Digitization and storage are most appropriate for items that researchers use continuously. In contrast, materials used episodically are best scanned on an on-demand basis. Materials may also be distinguished by type. One participant recommended converting older rather than newer materials because the former are not subject to intellectual property rights. Older materials may also be high priority for conversion if they are printed on paper with acid content. Another speaker proposed digitizing unpublished original documents, such as those appearing in the Library's American Memory project, rather than items that have gone through an editorial process.

Locating Digital Resources

Researchers need well-developed indices and finding aids to access and use information effectively. The distributed character of global networking, one participant observed, has produced a major change in responsibility for creating such indices. Increasingly, researchers who make information available through the Internet are providing some indexing for that information. The potential exists, therefore, that future creators of digital information will also develop appropriate locator systems for other researchers. Others expressed caveats to this position, however. Indexers of digital materials must do more than simply apply layers of technical finding aids. In particular, librarians need to be linked to this effort to utilize their skills in cataloguing knowledge. The information explosion also requires us to rethink radically the way that we manage networked information and the tools that we bring to that pro-

cess. New approaches that map individual data components as well as a total document will enable users to combine information in unique ways. There are significant business opportunities in figuring out how to direct people to digital information resources. Likewise, there are public responsibilities for providing locators to digital Government information.

Standards

The development of appropriate indices is also related, some noted, to the need for agreement on standardized formats for entering and retrieving digital information. Standards are necessary for establishing interoperability among various kinds of databases, as well as for acquiring digital information that can be incorporated into existing systems. The development of Government-wide standards to which agencies adhere would contribute significantly to creating digital libraries. At present, standards are being developed much faster than their adoption by users. The generators and distributors of information must reach a consensus not only on the nature but also the implementation of such standards.

Preservation

The rapid evolution of standards has further clouded the already complex issue of determining how to preserve digital materials. One participant observed that we do not understand how to refresh digital knowledge continuously for archival purposes. Given the distributed nature of contemporary systems, another speaker stated, distributed responsibilities for preservation of information must be negotiated. Criteria must be established to determine which digital materials ought to be preserved.

Funding Digital Resources

Building, locating, and preserving digital resources will be an expensive effort. For example, the Patent and Trademark Office has estimated that it will spend approximately $1 billion between 1983 and 2002 to develop, implement, and operate an automated patent system, including the digitization of its paper collection of patent documents. Determining how such conversion projects will be funded is a significant problem. Participants offered several creative funding options involving restructuring existing resources or identifying new revenue sources.

Governments at all levels, one speaker noted, expend vast amounts of money in exchanging information with the public. Information technology offers the possibility of significant savings in this area. By creatively applying public access multimedia technology, for example, California State employment officials estimate that they may substantially reduce the cost of matching individuals with jobs. These and other savings nationwide could then be passed on to critical research and educational projects, such as the digitization of historic materials.

Restructuring also offers a potential avenue for large-scale digitization of library resources. Existing funding streams, especially capital investment funds set aside for collections storage, can be diverted to create digital libraries. Indeed, as one participant observed, such efforts may allow libraries to pull their resources together and make parallel progress towards storing, accessing, and preserving collections materials.

By itself, however, restructuring may be insufficient to address the total funding requirement. As one speaker noted, information is rapidly becoming the "coin of the new realm." If

this is the case, he observed, should the public revenues needed to secure this public good come by taxing private activity in this area? Many local libraries, for example, are funded primarily through property taxes. Are new funding mechanisms needed to ensure widespread public access to non-commercial information?

CONCLUSION

The digital revolution provides a unique opportunity for collaboration among Government, industry, the public, and the library and educational communities. Participants concurred that we need to learn more from models of collaboration that already exist, particularly those that add value and help generate new knowledge. Clear Government roles exist to ensure the public interest and to support private investment and innovation. The Internet serves as a key example of how Government can prime much broader activity. Collective action is also essential in developing standards and promoting systems interoperability.

Participants agreed on the critical importance of protecting intellectual property rights in the digital era in promoting the creation and dissemination of new knowledge. Also important, however, is accommodating the principles of fair and equitable use for scholars and the public.

Finally, policymakers must address social and educational equity and reach communities of need. Training people at all levels must be a central component of the national information infrastrucutre effort. Libraries have a key role to play in providing equitable access to information for all citizens.

APPENDIX

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